MONITORING PLAN

PROJECT NO. CS-28 (XCS-48)
SABINE REFUGE MARSH CREATION

August 20, 2001

Project Description

The project area is composed of 3,300 acres located within the Chenier Plain in southwestern Louisiana, in the Calcasieu-Sabine Basin, west of LA Highway 27 and Calcasieu Lake. The area is within the Sabine National Wildlife Refuge and roughly bounded by, Starks North Canal to the north and east, Back Ridge Canal to the south, and existing marsh to the west (figure 1). Most of the soils in the project area are classified as either Clovelly muck, Gentilly muck, or Scatlake mucky clay, which are all level, poorly drained fluid soils (U.S. Department of Agriculture [USDA] 1995). Clovelly muck and Gentilly muck are organic and mineral soils respectively, found in brackish marsh, whereas Scatlake mucky clay, prevalent at the southern end of the project area, is a mineral soil found in saline marshes.

The vegetation in the area was classified as mostly saw grass marsh (*Cladium jamaicense* [saw grass], *Scirpus californicus* [giant bulrush], *Phragmites australis* [roseau cane]), with some fresh marsh (*Panicum hemitomon* [maiden cane], *Sagittaria lancifolia* [bull-tongue]), and intermediate marsh (fresh species plus *Scirpus americanus* [bulrush], and *Spartina patens* [saltmeadow cordgrass]) by O'Neil (1949). The vegetation has been classified as brackish (*S. patens, S. americanus, Scirpus robustus* [saltmarsh bulrush], *Ruppia maritima* [widgeon grass])since at least 1968 (Chabreck and Linscombe 1968, 1978, 1988). Most of the project is currently open water with brackish marsh on the surrounding edges.

Most land loss in the area occurred between 1956 and 1978 (United States Department of Agriculture [USDA] 1993) with the highest loss rate around 1965 (Dunbar et. al. 1990). The current land loss rate in the project area is approximately 0.5 square miles per year (United States Army Corps of Engineers [USACE] 2000). One major cause for the land loss is vegetation death caused by hurricanes, oil and gas canals and the subsequent altered hydrology, and saltwater intrusion via large navigation canals acting as conduits for Gulf of Mexico water (USDA 1993). Saltwater from the Calcasieu Ship Channel (CSC) had been introduced from several sources including the GIWW through Alkali Ditch and and probably more importantly through West Cove Canal via Back Ridge Canal (Miller 1997). Along with soil waterlogging, the introduction of saltwater into the area may have contributed to the loss of marsh. If the marsh vegetation was stressed by extended inundation periods, or the shift to more salt tolerant vegetation could not keep pace with the death of existing vegetation, then unvegetated mudflat may have resulted. Without vegetation to hold the substrate together or increase accretion, the marsh is more easily deteriorated. When the substrate elevation becomes too low, emergent vegetative growth is prohibited even if favorable salinity conditions

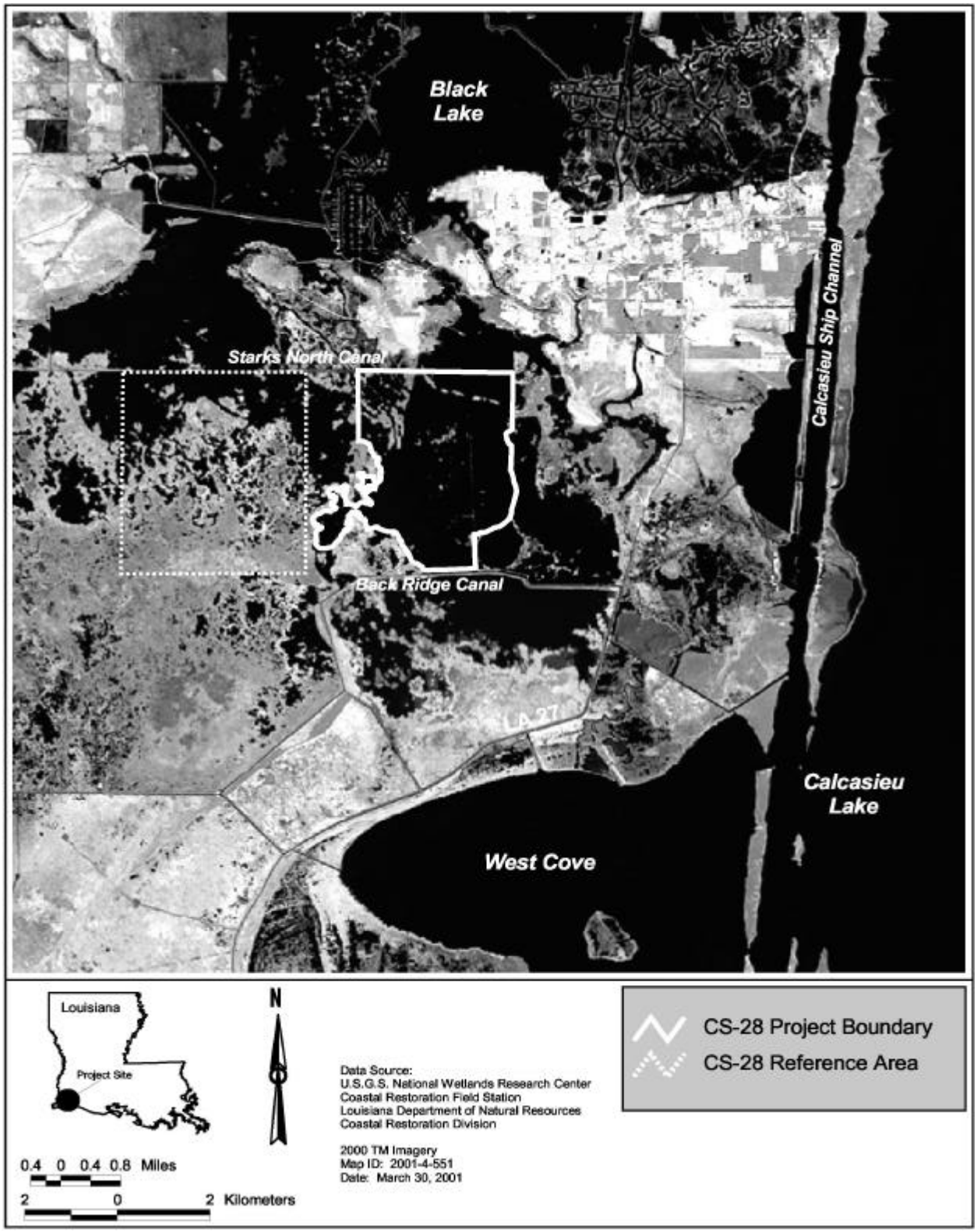

Figure 1. Sabine Refuge Marsh Creation Project (CS-28) project and reference area boundaries.

return (Turner and Cahoon 1987). Many fishery organisms utilize vegetated intertidal marsh, as indicated by relatively high abundances (Zimmerman and Minello 1984), and the restoration of this habitat would likely lead to greater fishery productivity (Turner 1977). The new higher elevation, and nutrient addition created by the dredge material is expected to allow vegetation to reestablish (Ford et. al. 1998; Turner and Cahoon 1987; Wilsey et. al. 1992).

The purpose of the project is to create emergent vegetated marsh, and to enhance and protect existing broken marsh mainly in the northwest part of the project area. During the 2001 maintenance dredging by the USACE, approximately 1,000,000 cubic yards of sediment will be dredged from the CSC and pumped into a diked area to create 125 acres of marsh in existing open water within the project area. This placement site is the first of five which will be used within the 2,850 acre open water area within the project area. The series of five dredging cycles will take place every other year, beginning in 2001. The initial height of the dredged material (slurry) is to be no more than +4.5 ft Mean Low Gulf (MLG) to settle to a final target elevation of approximately +2.5 ft MLG after initial consolidation. To contain the dredge material initially, perimeter earthen retention dikes will be constructed to a maximum height of + 7.0 MLG, with a minimum of 1:3 side slopes, and a 5 ft crown width. Interior earthen dikes will be similar but have a maximum height of + 6 ft MLG. The dikes will be allowed to remain until the dredge material has stabilized and been colonized by emergent vegetation. After stabilization, the remaining dikes will be breached to allow fisheries access (USACE 2000).

Meandering and curving trenasses will be constructed in areas of prevailing water flow prior to the placement of dredged material. It is anticipated that depressions will be left after the disposal is placed and that they will act as tidal creeks.

Should the project prove to be effective, the long term coupling of channel dredging and beneficial use of dredged material in the CS-28 project area and surrounding areas will allow continued marsh building.

Project Objectives

1. Create new vegetated marsh and enhance and protect existing surrounding marsh vegetation

Specific Goals

1. Place dredge spoil slurry to a maximum height of 4.5 ft MLG to settle to a height of 2.5 ft MLG, after five years, for each of five dredging cycles

2. Create 125 acres (first cycle) of emergent vegetated wetland, and undetermined amounts of emergent vegetated wetland in cycles two through five

3. Reduce loss of existing surrounding marshes within the project area

Reference Area

Monitoring appropriate reference areas concurrently with the project allows time controlled evaluation of the project's effectiveness. The main criteria for selecting a reference are similar soil type, vegetation, hydrology, and proximity to the project area.

The marshes west of the project boundary, in the Hog Island Gully Project (CS-23) area (extending west approximately 3 miles from the project western boundary, with the same northern and southern boundaries as the project area), will be used as a reference area for the emergent vegetation monitoring in the surrounding marshes outside of the created marsh in the project area. The vegetation in this section of the Hog Island Gully Project area is the most similar to that of the CS-28 project area. These marshes are currently being monitored as part of the Hog Island Gully Project, which includes vegetation sampling (currently at ten stations in the proposed reference area) that will complement the proposed vegetation monitoring in this plan.

Monitoring Elements

1. Aerial Photography — To document land to open-water ratios and land change rates, color-infrared aerial photography (1:24,000 scale) will be obtained post-construction in year 2002, and additional photography will available from the Hog Island Gully Project, which includes the CS-28 project area, for years 2004, 2009 and 2018. Pre-construction photography is also available from previous work done for the Hog Island Gully Project. The photography will be processed by National Wetlands Research Center (NWRC) personnel using standard operating procedures documented in Steyer et al. (1995) for determining land-to-water ratios and corresponding acreage through GIS analysis.

2. Emergent Vegetation — To document the condition of the emergent vegetation in the project area over the life of the project, vegetation will be monitored at sampling stations using a modified Braun Blanquet sampling method as outlined in Steyer et al. (1995). Transects will be established uniformly across the created marsh and the associated surrounding existing marsh. The position of the transects will also be such that they coincide with at least some of the elevation transects. Sampling stations will be established uniformly along each transect line to obtain an even distribution of sampling stations throughout the project area. Percent cover, dominant plant heights, and species composition will be documented in 2m X 2m sampling plots marked with 2 corner poles to allow for revisiting the sites over time. Descriptive observations of submergent vegetation will be noted during monitoring of emergent vegetation. The location of any

plantings that may be installed will be noted to minimize confounding with the created marsh vegetation data. Vegetation will be evaluated at the sampling sites in the late summer of 2001, 2002, 2004, 2006, 2008, 2010, and 2017.

3. Elevation Survey — The elevation of the placed dredge material will be documented within placement sites for each dredging cycle (1-5) by an elevation survey. The trenasses expected to be created will be included in the survey. Elevation measurements will be recorded after one year of consolidation and at an interval of once every other year for each cycle. Therefore surveys will be conducted in years 2002, 2004, 2006, 2008, 2010, and 2017 (see Notes).

Anticipated Analyses

The following describes statistical procedures, and hypothesis tests that will be used to analyze data collected for each monitoring element included in this monitoring plan to evaluate accomplishment of the project goals.

1. Aerial Photography: Descriptive and summary statistics on historical data (for 1956, 1978, and 1988) and data from color-infrared aerial photography collected pre- and post-construction will be used, along with GIS interpretations of these data sets, to evaluate marsh to open water ratios and changes in the rate of marsh loss/gain in the project area. Change in the marsh loss/gain will be determined for the project area with and without the inclusion of the created marsh cells.

   Goal: Increase present (yr 2001) emergent marsh area by 125 acres with the first dredging cycle, reduce the loss rate of existing marsh, and increase emergent marsh area in future dredging cycles

2. Emergent Vegetation: The primary analyses for detecting project impacts on emergent vegetation outside of the marsh creation cells will be an analyses of variance with area (project vs. reference) and time (pre-construction vs. post-construction) as fixed effects. The vegetation within the created marsh cells will be evaluated using descriptive statistics and comparisons among post construction data sets.

   Goal: Increase the cover of emergent vegetation in the actual dredged material placement area and reduce the loss rate of the surrounding marsh within the project area

   Hypothesis:

   H_0: Mean cover of emergent vegetation will change similarly in the project (existing marsh) and reference areas after construction.

H_a: Mean cover of emergent vegetation will change differently in the project (existing marsh) and reference areas after construction.

3. Elevation Survey: To determine the mean elevation at the times when the target elevations are expected to be attained, a single population t-test will be used. A one way ANOVA with repeated measures may be used to determine if the mean elevation changes in the future after the initial target heights are measured.

Goal: Place dredge spoil slurry to a maximum height of + 4.5 ft MLG to settle to a height of 2.5 ft MLG after initial consolidation (five years after placement)

Hypothesis 1:

H_0: The mean elevation of the placed dredge material after initial consolidation will be 2.5 ft MLG

H_a: The mean elevation of the placed dredge material after intial consolidation will not be 2.5 ft MLG

Notes

1) Proposed Implementation Schedule

(1st cycle):	Start Construction	April 2001
	End Construction	August 2001
2nd cycle	Start Construction	April 2003
	End Construction	August 2003
3rd cycle	Start Construction	April 2005
	End Construction	August 2005
4th cycle	Start Construction	April 2007
	End Construction	August 2007
5th cycle	Start Construction	April 2009
	End Construction	August 2009

2) USACE Point of Contact: Jay Gamble (504) 862-2786

3) DNR project manager: Herb Juneau (337) 893-3643
DNR monitoring manager: David Castellanos (337) 893-3643

4) USFWS project manager: Darryl Clark (337) 291-3111

5) Sabine NWR manager: Chris Pease (337) 762-3816

6) The twenty-year monitoring plan development and implementation budget for this project is $160,378. Data and Summary Graphics will be available in 2003, 2009 and comprehensive reports will be available in 2005, 2011, and 2020. These reports will describe the status and effectiveness of the project.

7) Available ecological data, including both descriptive and quantitative data, will be evaluated in concert with the statistical analysis to aid in determination of overall project success. This includes ancillary data collected in the monitoring project but not used directly in statistical analysis, as well as data available from other sources (USACE, USFWS, LDNR, LSU, etc.).

8) As of this writing it has not been decided which agency will conduct the elevation surveys of the dredge material. If the USACE does not conduct initial surveys, additional funds will be needed for elevation surveys.

References

Chabreck, R.H., and C.M. Hoffpauir 1962. The use of weirs in coastal marsh management in coastal Louisiana. Proceedings of the Annual Conference of the Southeastern Association of Game and Fish Commissioners 16:103-112.

Chabreck, R. and G. Linscombe 1968. Vegetative type map of the Louisiana coastal marshes. New Orleans: Louisiana Department of Wildlife and Fisheries. Scale 1:62,500.

_____1978. Vegetative type map of the Louisiana coastal marshes. New Orleans: Louisiana Department of Wildlife and Fisheries. Scale 1:62,500.

_____1988 Vegetative type map of the Louisiana coastal marshes. New Orleans: Louisiana Department of Wildlife and Fisheries. Scale 1:62,500.

Dunbar, J. B., L. D. Britsch, and E. B. Kemp III 1990. Land Loss Rates: Report 2, Louisiana Chenier Plain. Technical Report GL-90-2, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Ford, M. A., D. R. Cahoon, and J. C. Lynch 1998. Restoring marsh elevation in a rapidly subsiding salt marsh by thin-layer deposition of dredged material. Ecological Engineering 10, 131-158.

Miller, C. M. 1997. Rycade Canal Project (CS-02) Monitoring Series No. C/S-02-MSTY-07097-1 Three year comprehensive report No. 1. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

Mueller-Dombois, D., and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York.

Nyman, J.A., and R.H. Chabreck 1996. Some effects of 30 years of weir management on coastal marsh aquatic vegetation and implications to waterfowl management. Gulf of Mexico Science 14:16-25.

O'Neil, T. 1949. The muskrat in the Louisiana marshes. Louisiana vegetation map. Louisiana Wildlife and Fisheries Commission, New Orleans, LA.

Steyer, G.D., R.C. Raynie, D.L. Steller, D. Fuller, and E. Swensen 1995. Quality Management plan for Coastal Wetlands Planning, Protection, and Restoration Act monitoring program. Open-file series no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

Turner, R. E. 1977. Intertidal vegetation and commercial yields of Penaeid Shrimp. Transactions of the American Fisheries Society 106: 411-416.

Turner, R. E., and D. R. Cahoon, editors. 1987. Causes of wetland loss in the coastal central Gulf of Mexico. Volume II: Technical Narrative. Final report submitted to Minerals Management Service, New Orleans, LA. Contract No. 14-12-0001-3252. OCS Study/MMS 87-0120. 400 pp.

United States Army Corps of Engineers 2000. Unpublished report. Environmental Assessment, Sabine Refuge Marsh Creation, Cameron parish, Louisiana, EA #319.

United States Department of Agriculture, Natural Resources Conservation Service 1993. Calcasieu-Sabine Cooperative River Basin Study Report. Unpublished report. In cooperation with the Gulf Coast Soil and Water Conservation District, United States Fish and Wildlife Service, Louisiana Department of Natural Resources, Louisiana Department of Wildlife and Fisheries, and Louisiana Department of Agriculture and Forestry. 152 pp plus appendices and maps.

United States Department of Agriculture, Natural Resources Conservation Service (NRCS) 1995. Soil survey of Cameron Parish, Louisiana. Publication No. 1995-386-441/00020. Washington, D. C.: U. S. Government Printing Office. 135 pp, 122 maps. Scale 1:20,000.

Wilsey, B. J., K. L. McKee, and I. A. Mendelssohn 1992. Effects of increased elevation and macro- and micronutrient additions on *Spartina alterniflora* transplant success in salt-marsh dieback areas in Louisiana. Environmental Management 16: 505-511.

Zimmerman, R. J., and T. J. Minello 1984. Densities of *Penaeus aztecus*, *Penaeus setiferus*, and other natant macrofauna in a Texas salt marsh. Estuaries 7: 421-433.